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AUTHOR Burton, Frances D.
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ABSTRACT

This paper describes a primatology project using computer assisted learning and interactive multimedia to help students at the University of Toronto (Canada) learn about non-human primates. The purpose of the interactive program is to present the "natural history" of the majority of the 200-plus species of non-human primates in constant association with that species' portrait and a map of its distribution. Nine categories of information are grouped under the major headings of Attributes, Ecology, and Social Behavior. The paper describes the procedures for accessing information in the multimedia package and discusses pedagogical considerations of active learning and image association. The program is intended to be an adjunct to an introductory course, used in conjunction with lecture and other instructional styles with an introduction to research. Still in the experimental stage, this multimedia program has not been formally tested. Costs and expenditures are discussed. (EH)

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MULTIMEDIA IN ANTHROPOLOGY: A GUIDE TO THE NONHUMAN PRIMATES

Frances D. Burton
Professor
Scarborough Campus, University of Toronto
1265 Military Trail
Scarborough, Ont. M1C 1A4.

BACKGROUND

Primatology is a field that is visually based. It's subject matter is nearly 200 species of non-human primates who are brightly coloured and decorated with crests, tufts, tails, tassels and even furry tiaras. The subjects' behaviour is also visual: the entirety of their existence is in the immediacy of endeavours within their visual fields, and therefore in front of the primatologist as well. A dominance interaction, or a grooming bout is the stuff of life. Theory, in primatology, abstracts causation from such visible events. Its credibility depends on its connection with this visual evidence.

The study of non-human primates can be traced to Aristotle and Galen, but the field itself began under the auspices of Anthropology only in the late 1950's. When Primatology was young, only thirty years ago, it was based on descriptions of the natural history of non-human primates, and the verbal depiction produced emulated a visual one. Primatologists were encouraged to develop a methodology that would achieve this (e.g. Carpenter, 1964). Good narrative, such as Goodall's IN THE SHADOW OF MAN, produced credible images of life, made tangible by films. Those films provided the images which, used by an active imagination, modeled for those species one could only read about. Material was approachable, concrete, exciting. It was located in the primates themselves. At the end of term, students would leave with a repertoire of images from which they could draw in the future, from which they could extract principles and processes leading to theoretical rules.

As the field has matured, it has sought to explain observations; to develop scientific rationalization in keeping with current paradigms. The current fascination is with reproductive strategies, thermoregulation (e.g. Paterson, 1992), body weight as predictive of foraging domain, cognitive abilities (e.g. Burton, 1992), and machievellian intelligence (e.g. Dunbar, 1988; Whiten and Byrne, 1988). That impressive literature draws data from a given species, but the species are no longer the actual subject matter. What were subjects are objects - reference points as background to theory. In this atomization, the primates themselves have become increasingly remote. The contemporary student, sophisticated in theory and method may not actually recognize the animal discussed in the literature.

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TEACHING PRIMATE STUDIES

Basic to the study of non-human primates is some knowledge of their classification. 'What's in a name', to answer that conundrum, is where the animal fits with reference to all the other species within the Order, Primates. Its taxonomy reflects its evolutionary history. Knowing who an animal is tells who its relatives are, how long its group has been around, and some suggestion of its behaviour. Placing a species within 'Microcebus' evokes certain traits like nocturnal activity, nesting behaviour, and solitary foraging; naming an organism a macaque, identifies group living, a goodly amount of terrestrial activity, sophisticated social organization based on a female matriline.

Traditionally, teaching classification was accomplished with blackboard or overhead projections of charts, diagrams and - above all - slides. Sophisticated introductions to taxonomy provide slide-trays for lab use with written or narrative description beside them. The exposure to these images is usually done in part of the first semester. The slide tray may be left in the library or the lab. Review of this material, naturally, is difficult. There are picture books (e.g. Napier and Napier, 1985) which provide photos representing the genus with only a generalized description, and which, in any case, do not cover more than a small representation of all the species. Assignments focus students on particular species, so that at least those can become intimately known as reference points, but for certain, the casual mention of a different species within a genus will not have the student rush to find an image of it; motivation is dampened by the difficulty in finding a picture. A "field" trip to the zoo with graduate students trained in a variety of institutions from all over North America, demonstrated this. Despite lectures, readings, and superior performance on term papers and exams, these graduate students were not able to identify some of the least rare or exotic amongst the Order, Primates. Clearly where emphasis could not be given due to a lack of materials, students were not able to function. The reams of articles s/he will read will develop a verbal sophistication about species, but s/he will retain visual ignorance. Consequently the subject matter is not real because it has no visual referent; the theory is meaningless because it is not grounded.

COMPUTER ASSISTED LEARNING: INTERACTIVE MULTIMEDIA

Computer technology has transformed research methodology and with it the presentation of information. Most recently, that technology emphasizes visual material which makes it eminently suited to teaching about non-human primates. Called Multimedia, sound, text, moving and still images are integrated. When the user controls access to this information, it is called Interactive Multimedia. Because so much information can be stored and easily retrieved, Multimedia is multi-layered. Information can reside on a CD rom at different levels of difficulty: terminology can be explained with a glossary, pronunciation can be made available under the click of a key. John Dewey's aphorism, "we learn by doing", is the essence of this new form of instruction.

Using Multimedia is an extension of the lab environment where the student becomes the active learner, utilizing materials as resource. Maria Montessori stressed the value of discovery in the development of independence. Multimedia provides this value because it is layered; information can reside at different levels of difficulty or detail so that users with different capabilities can utilize the same resource, and, more importantly, the student is encouraged to extend him or herself to explore beyond the confines of an assignment.

DEVELOPING THE PROJECT

When this new technology was introduced to my campus at the University of Toronto, it seemed it might afford a tool to overcome the difficulties that I had encountered in teaching primatology. In 1990, in association with a computer programmer, Matthew Eaton, I began developing this kind of interactive programme, intended as an adjunct to a course about non-human primates. A pioneer in its field, this work has variously been termed 'software', 'courseware' or, more accurately, an 'electronic book'. It is currently in distribution with Prentice Hall. This Multimedia work is scripted in Authorware@ Professional, and will be distributed for both Windows(R) and Macintosh(R) on CD Rom. Videos run in Quicktime (TM).

The purpose is to present the "natural history" of the majority of the 200 some species of non-human primates in constant association with that species' portrait, and a map of its distribution. Nine categories of information are grouped under three major headings: Attributes, Ecology, and Social Behaviour. References are found in the Bibliography which contains primary sources so that the student is acquainted with the work of field researchers. Six utilities, accessible by clicking on icons at the bottom of the screen take this work from simple association of face to name, to an instructional tool giving the student the ability to compile bibliographies, search for terms, take notes and make presentations.

THE STRUCTURE

The blue screen colour was chosen to be easy to see, permit good contrast, remain in the background while enhancing use of the programme. Lettering in contrasting colours, most usually pink, red or black. From the Title screen the user goes to the Contents screen by clicking on the "begin" button. Here the common name of the four major groupings of non-human primates is presented. The common, rather than scientific name was chosen on Dewey's principal of going from what you know to what you don't know. Familiarity encourages the student to use the programme, to associate a more technical term with one that is already known. The choice brings up the taxonomy of that grouping, from which a genus can be chosen. Thus, the choice, "Old World Monkeys" leads to a listing of the families of Old World Monkeys, (e.g. Cercopithecidae) beneath each of which is listed the common names of their respective genera (e.g. baboons, macaques). When this last choice is made, a list of species appears to the right of the

screen, above which is a box containing a small picture and the common and latin names of the species. Clicking on the photo brings up the species screen.

Images and text appear in the top two-thirds of the screen, utility icons appear in the bottom third. A large picture of a representative of the species appears on the left. Clicking on this picture expands it still further, so that it is full screen. Directional arrows are activated to browse through the selection of these which range from one photo to about four. The name is in Latin above the image, the common name and the author of the photo below it. To the right of the picture is the continental map with country names in white and areas of this species' distribution marked out in brown. The information categories are listed beneath the photo: Conservation, food and diet are grouped under Ecology. Taxonomy, fossil record, physical features, are basic Attributes; the life cycle, communication, and social dynamics are included in Behaviour. To choose a topic, the student either clicks on the topic (foods and diet, etc.) or clicks the Browse button, which permits moving sequentially through the topics. The text information itself appears over the map on the right. Terms that are likely not to be familiar are highlighted in pink and can be found by clicking on the Glossary button beneath the text. The term is defined, and directional arrows in the Glossary permit browsing through the entire set of terms. The utilities include the Quit, Index, Search, Notes, Quiz, "movie" and Select buttons as well as directional arrows. Video, where available, is accessed by clicking the appropriate icon the "movie" icon to get up to 30 seconds' impression of this species. A miniature video screen appears and operates rather like the typical VCR, with forward, backward, and stop controls. Pronunciation of the species' name is gotten by clicking on the latin name above the photo on the left side of the screen.

Movement between species can be effected in more than one way. There are large directional arrows to the far right of the screen in the bottom third. These progress through the list of species already chosen. Clicking on the Select icon brings up that list, permitting direct choice. There is always the option of returning to the Contents menu, and proceeding from that entry point. Alternatively, the choice is by way of the Index which is structured to give easy access to any species. It has special value in devising assignments, lectures, exams and research. Four choices appear in the Index: by continental region, by taxonomic group or by user-defined group. The final choice is to create a custom-designed user group. Species can be accessed from lists brought to screen by clicking on the chosen continent. The taxonomic chart lists all primates within their families. Clicking on a particular group, e.g. Cercopithecidae places it within a list titled by the family name, with all species members included. Highlighting the preferred species produces the small photo to the right at the top of the screen. User-defined groups can be made by activating the final choice in the Index list. A window opens which has word-processing features: add, delete, copy, save, and print. Selections of which species to put into

this group are made by continental region or from the taxonomic chart. The group list is saved, and can be retrieved by choosing to open-group-from-file in the Index.

Notes is an on-screen device called up with a click on its icon, which permits note-taking, or transferring text from screen to notebook so that it can be saved, even downloaded to disc or printer.

The final button along the bottom of the screen, is the Quiz. This choice enables the student to review what s/he has just been doing. The quiz can be set random over the entire photo data base, or selective as to a particular group. The quiz requests the latin name for the image and offers the correct answer should the student request it. The student may "try again", "give up" or "quit". An incorrect answer is noted in a soft red-with "Sorry, that answer is incorrect", while a correct one is marked in green, with the single word "Correct".

PEDAGOGICAL CONSIDERATIONS

The computer was enlisted as the tool of choice because visual information is readily accessible and can be linked to sound and text. Consideration was given to pedagogy, emphasizing facility of use and comprehension, student control of amount, of information received and self-evaluation. There is no punition - not even in the Quiz - so learning decreasing factors such as humiliation are not there. The goal of the instructor is to activate the learner in a student. Kulik and others have shown that computer assisted learning provides an advantage because learning time is reduced since students have positive attitudes towards using and learning from computer programmes. The actual time spent on a learning task is therefore diminished (Kulik, et al., 1983; Niemic and Walberg, 1987). Because images are pleasing, and because the user controls the process, repetitions are more likely, so that assimilation of material is ensured. Repetitions are effortless because the pace of work is governed by the user. The student's past experience with images on monitor, however, influences how the student uses the interactive program. Exposure to hours of television a week means that mechanisms to "dump" information will be well developed. This means fashioning a programme to become sufficiently important to keep attention focussed. In this work, text length has been kept basic and relatively brief: the point is to gain (and seek) elementary information for a number of species. Further, detailed work is accomplished through following leads in the Bibliography. An educational programme needs also to compete with the cleverness of computer games. Student sophistication in this area is to be expected, and their expectations means that while the progamme, and the context in which it is utilized is educational, the use must be gratifying and enjoyable. The nature of the utilities enhance the pleasureable aspects of this work, bringing in specific activities which are fun to use. The choice of screen colour matters. Too many colours can be confusing (Dyer and Lamberski 1982-83) so that the right number and tones are important. Colours were chosen not only for their aesthetic appeal, but for

their qualities: attention getting, ease of reading, contrast, and novelty (Heinich et al., 1985). Placement of material was considered against several criteria: eye movement, and hand movements are required to get at the information. The structure of the screen was developed consistent with current understanding of the process of scanning (Steinberg, 1991:150-151.): the photo is on the top left, the text activated on the right over the map with sufficient linear distance for width and length to be read easily. The distance over which the cursor needs to travel to activate choices was considered as well as the placement of icons which offer the choices to access information and activities. We have placed our photos and positioned the objects with this in mind. While the evidence of the direct effect of these considerations is not clear, Heinich et al.(1985) have found that they work on motivation and increase attention as well as length of contact.

True "interaction" occurs only between the student and him/herself, by means of the material presented. We do not "teach", we present information. Learning is up to the student. Either the student is thinking or s/he is not. "...instruction", as Wittrock has noted, "involves stimulating the learners' information-processing strategies, aptitudes and stores of relevant specific memories in relation to the information to be learned." (Wittrock 1979:10).

Every choice is active: which species, what topic, which way of several to get at the information- each requires the user's evaluation. Related information on screen has been placed in different locations so that there is physical activity since prolonged use would otherwise become tedious.

The time required for the computer to change images is called the refresh time. It was imperative that this time be as short as possible to avoid impatient repeated clickings to have the next choice appear which might potentially crash the system. Language use was modeled on the general textbook. Clarity and simplicity were emphasized. It was assumed however, that the user had some background in highschool biology, so that terms and concepts such as taxonomy, genus or species, would be familiar. Although the program is meant only as an adjunct to a lecture course, technical terms are defined in text or found in the Glossary; Latin terms are introduced after the English ones, so that the progression is from what is known to what is not known and the student is not overwhelmed. Pronunciation of Latin names is available by a mouse-click. Possession of information on a species cannot occur if there is no acoustic model of its name. A compromise between british and american pronunciation of latin names was made by offering both as necessary.

The purpose of this programme is to associate information with an image. Since image recognition is represented in memory averbally, (Steinberg 1991), and since thousands of images can be easily stored (Haber, 1970), the task was to find ways to connect images to an arbitrary meaning. There is no intrinsic connection between a species name and its portrait; its fossil history and its geographical distribution. By use of repetition, however, the

name of the primate is associated with its image and geographic distribution. In each species' descriptive screen, as well as in the small identification boxes of the Index, this association is made. In addition, the self-quiz is reinforcing. Not only is information redundant to ensure reception of it, but access to information has been made redundant. While an egregious error in essay writing, redundancy in communication is a primate attribute. Gesture for example, reiterates inflection thus ensuring transmission of a message. Since learning itself is idiosyncratic (Steinberg, 1991), with some people more visually inclined and others more verbally inclined, redundancy of information assures access. An individual's personal logic is accommodated when there is more than one way to get at information.

Credibility is important for the programme to be acceptable, and to indicate the route to further information as well. The Bibliography has been placed just below the main topics. It gives the major sources for information on a given species so that the student can verify what has been included, and begin further research. Copyrite for each image and soundbyte has been obtained, so that the field researchers are directly included.

INSTRUCTIONAL USE

As an adjunct to an introductory course, this programme is intended to be used in conjunction with a lecture, wherever visual material is needed as illustrative. The instructor selects the appropriate species from either the scientific or common names available in the Index and compiles them into a temporary data base for the day's work. Clicking on the identification image expands it to full screen, so that a slide show can be presented. This collection of species can then be used as the lab. assignment. The Index permits the selection and transfer to defined groups. Ease of use means organization can be done on impulse, given availability of the machine and an appropriate projector or LCD panel. The Notes enhances the student's utilization, by facilitating recording thoughts, impressions, ideas, facts and transferring text - directly, on-screen.

Assignments based on available content, that is the nine topics and Bibliography, as well as the visual data base, can be devised as preliminary to major library work. These have been set out in the User's Guide (Burton, 1995) and might take the following forms: "Select four Old World species, and four New World species and contrast their diets being sure to evaluate body weight and habitat use." "Watch locomotion in two atelines and two langurs. What physical structures are involved? What are the proportions of limbs? What differences do these make? Which animals are larger? Which is heavier?" "Choose two genera that have more than four species. Examine their pictures and note obvious differences in morphology and pigmentation between these. What other evidences are known to distinguish these as species?"

While the programme is intended to be introductory, it does permit a taste of research. A word search capability has been included, and is located in the Index. The student first selects the major topic, such as taxonomy or social dynamics, and then

gives the search term. In this way, s/he can ask for each and every species which, for example, eats eggs, or which weans their offspring at over one year, or which is endangered.

One of the most significant aspects of Computer Assisted Instruction, especially in multimedia form, is user directed learning. Students can evaluate their progress as they proceed. The Quiz presents images of non-human primates to identify. Entering a response evaluates it, with the option to try again or exit. When the answer is not known, the student can request the information. The instructor can set quizzes utilizing user defined groups as source for questions. In a similar way, exams can be written using the data base -textual and visual- as source material. The Quiz feature of the programme is amenable to this endeavor.

EVALUATING THE PROJECT

Multimedia is a new way of conveying information. Assessment instruments are yet to be developed that specifically evaluate multimedia presentations. In their need to evaluate new technology as opposed to old ways of doing things, university instructors have too often employed inappropriate tools. Multiple choice questions used to evaluate student's absorption of lecture or reading material have yet to be demonstrated effective in testing multimedia where information is not linear, and where it is the association of kind of information to another kind of information that is stored. Testing is done of the student - of the end goal, the absorption by the student of the content of the programme. It is assumed that student scores on content reflect the value of the programme. However, the process of delivery, that is the [a] the information itself and [b] the conveyance of information [the programme] are not tested in this manner. Steinberg (1991) is concerned with evaluation of the programme, first in its development and at its completion. She suggests that there is an important difference between formative and summative evaluation. Formative evaluation requires that the multimedia project must be developed with its audience in mind, during the course of its development. Summative evaluation tests learning itself, by noting such things as the number of students who complete a lesson, the time it takes for them to do so, exposure to the content of the program in the length of time the program is used, and course dropout rate.

We have been testing our programme since its inception. Volunteer students and volunteered students were watched using the programme, to observe eye and hand movement, to evaluate how much instruction would be necessary to use the programme, how they were absorbing the information. Interviews thereafter asked for suggestions on how to clarify the delivery of information and how to make the textual material more clear, for example, what terms to include in the Glossary. Over the past several years, the programme has been in the library while still under development. As it has only recently been published, the MULTIMEDIA GUIDE TO THE NON HUMAN PRIMATES has not been formally tested. It has been used, however, in two undergraduate courses and one

graduate course. In the General Anthropology Course, it was used as a library adjunct during the segment on the Primates, especially preceding studies at the zoo. Knowledge of their natural history from the "wild" as well as moving images of them enables the student to devise projects at the zoo that are valid as well as viable. The professor responsible for this course and her teaching assistants noted that in previous years the level of zoo project the student was able to engender was extremely basic; in addition, the student assumed that the members of the species observed at the zoo were representative of the species. As first year students, their bibliographic searches were rudimentary, and some sources were simply not available. Their observations were naive and simplicistic. Through exposure to the programme, both through formal assignments to use the User-defined group on the zoo primates, and additional researching, their recent work reflects a greater appreciation of the literature, of what is known about these animals and the amount of time spent in observation exceeded the assignment requirement.

The field studies course members are asked to become 'experts' on one of the species under study in the polyspecific grouping of the research area. In the past students might find the original description for his or her species, but were not able to continue the search for more up-to-date information. Subspecies were not seen, and comparative material between subspecies could not be examined. While it is true that it is easy to motivate a small self-selected group of students, the work done with the programme clearly was vastly better than in years prior. Not only were students readily able to become 'experts' on their species, they could augment their basic work by allocating the time formerly used to acquire basic information to finding material more difficult to obtain, and delving more deeply into material. In the introductory course in primate studies, my aim was to evaluate recognition of species. Primates were introduced in lecture with the programme, and students assigned to review that user-defined file in the library. When tested against prior years, performance was markedly improved. In years past, students' recognitions of primates averaged about chance; after the programme they tended to be 80-90% accurate. But what is more significant, these high scores were accompanied by the ability to pronounce the species name, and locate where the species lived. Since this exceeded my original purpose in developing this work, I am quite happy with the results.

COSTS AND MISCELLANEOUS

This work had direct costs of under $30,000 dollars (CDN). These direct costs include the salary of the programmer and some equipment. My labour was not included, as faculty are writing books, doing research and giving colloquia in any case. Equipment that was purchased was bought for general use by faculty members for a variety of purposes.

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Andrew J. Petto, PhD
Coalition for Education in the Life Sciences
Center for Biology Education
675 WARF, University of Wisconsin
610 North Walnut Street
MADISON WI 53705-2397